Please print out this form (two-sided, if you can) and write your answers legibly in the spaces provided. If you can’t write legibly, type.

1. Suppose we have a processor with an instruction cache that can store $N$ words, and that the processor executes a “straight-line program” (that is, a program with no branch instructions) with $10N$ instructions. Does the cache make this program run faster than it would run if there were no cache? Why or why not? Suppose the processor executes a program that consists of a loop with $N$ instructions that is executed 10 times. Does the cache make this program run faster? Why or why not?

2. Suppose the WASHU-2 is equipped with a fully associative data cache that contains the following (key,value) pairs $(1234,2045)$, $(1237,2323)$, $(1238,8abc)$, $(2045,2)$, $(3323,3)$, $(1045,5)$, $(abcd,7)$, $(1abc,b)$... Now suppose the processor executes a program that includes the three machine instructions shown below. Which of these instructions finds its data in the cache, and which ones must retrieve the data from main memory? For those that find the data in the cache, what values are retrieved?

\[
\begin{align*}
1234 & \rightarrow 2045 \\
\ldots & \\
1237 & \rightarrow 2323 \\
1238 & \rightarrow 8abc
\end{align*}
\]
3. The direct-mapped cache uses the low order bits of the main memory address to select a word from the cache and stores the high order bits as a tag. Suppose this was reversed? How would the performance be affected?